ALIGHT
SUSTAINABLE AVIATION

D8.6 Replication toolbox for SAF

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Content

1 Executive summary

This deliverable presents The Replication Toolbox developed within the ALIGHT project. The replication toolbox is designed to facilitate knowledge transfer and practical application of solutions, lessons learned, findings etc. done in ALIGHT to other airports. Its primary audience includes airports, and related stakeholders transitioning towards sustainable operations.

The Toolbox is structured to ensure easy navigation, offering a clear overview of key findings, theoretical foundations, and tailored guidance for different user groups. All tools are organized into two workstreams (SAF and Smart Energy), each with clear boundaries and focus areas.

The SAF Toolbox covers information on SAF feedstock, production pathways, certifications, logistics and airport infrastructure. The toolbox also includes replication tools on increasing SAF uptake.

Each tool is accompanied by descriptions outlining its purpose, target users, and guidelines for application. The tools range from handbooks, diagrams, excel-sheets, guidelines and checklists.

A key component of the ALIGHT Toolbox is its online platform, currently under development, which aims to make these resources accessible to a wide audience.

In summary, the ALIGHT Replication Toolbox combines practical tools, methodologies, and insights to guide airports and stakeholders in implementing sustainable, smart energy solutions, promoting the broader adoption of best practices across the aviation sector.

2 Reading guide for toolbox

The Replication Toolbox of ALIGHT is designed to facilitate a comprehensive understanding and application of replication strategies across two distinct workstreams:

A. Sustainable Aviation Fuels
B. Smart Energy Supply and Use

The replication toolbox for each of the workstreams are described in D8.6 (SAF) and D8.7 (Smart energy). To ensure consistency between the two workstreams, all or parts of the more generic sections are identical in the two deliverables, as developed through close cooperation between authors from Copenhagen Airports and authors from Danish Technological Institute.

The Toolbox is structured to ensure ease of navigation, enabling users to access the relevant tools and information tailored to their specific needs. It provides users with a streamlined experience by offering a clear overview of key findings, theoretical foundations, and the target audience, along with a breakdown of how stakeholders along the value chains can benefit from its solutions.

The opening sections offer a high-level overview, starting with the *Executive Summary*, which presents the report's key findings, objectives, and recommendations, providing a snapshot of the Toolbox's overall content. Following this, the *Background and Concept* outlines the foundational considerations and rationale behind replication strategies, explaining why replication is critical for both workstreams. Next, the *Target Group* section identifies the primary audience, highlighting those who will benefit most from the replication strategies and offering tailored advice for different user groups. Finally, the *Value chains and stakeholders* section illustrates how the Toolbox supports airports and stakeholders, offering customized tools and guidelines for various stages of the value chain. The reports (D8.6) 'Replication toolbox for SAF' and (D8.7) 'Replication toolbox for smart energy', have been co-developed, being the reason for the similarities until chapter 5; Boundaries and value chain for SAF toolbox.

As the Toolbox delves deeper into practical applications, it divides into two distinct workstreams, each addressing specific challenges and strategies:

2.1.1 Boundaries for Workstream A & B

This section defines the scope and limitations of replication efforts for both workstreams. It clearly defines what is included and excluded in each workstream, ensuring users have a precise understanding of the focus areas. Furthermore, *Why is it relevant to replicate?* addresses the importance of replication for both workstreams, offering detailed reasonings and outlining potential benefits for users and stakeholders.

Toolbox Inventory

In this detailed section, users will find a comprehensive list of all the replication activities and tools available within the Toolbox. Each tool or activity is accompanied by a clear description that explains its purpose, relevance, and practical application. This inventory serves as a roadmap for users to navigate the Toolbox and select tools that align with their specific replication needs, ensuring that every resource is both accessible and functional.

Appendix

The Appendix houses *the tools*, including methodologies and resources necessary for effective replication. These tools range from Excel templates and video tutorials to guidelines and checklists, all designed to offer hands-on support. Each tool is aimed at providing users with actionable steps, ensuring they have practical guidance throughout the replication process. The appendices serve as an in-depth *Toolbox*, where users can explore the tools most suited to their individual replication goals.

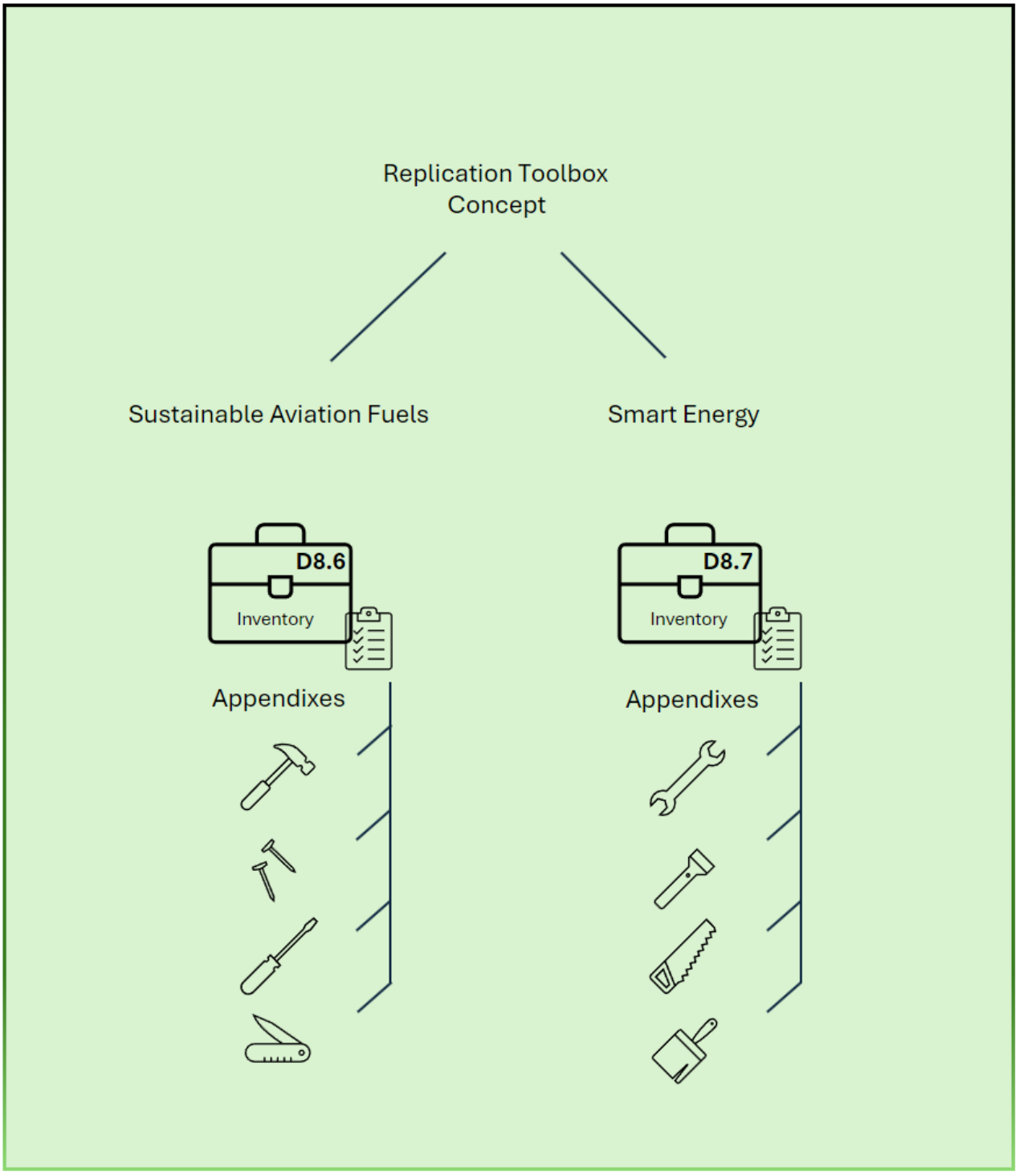

Figure 1 – Illustration of the toolbox concept where tools from the two workstreams make up the toolbox

3 Introducing ALIGHT

ALIGHT is an EU 2020 Horizon project: A Lighthouse for the Introduction of Sustainable Aviation Solutions for the Future (ALIGHT). The consortium consists of 17 partners who have jointly committed to addressing the challenges of creating a transition in the aviation industry. Spread across 10 different European countries, the ALIGHT partners range from European airports to technology providers and knowledge institutions. With the addition of AIRBUS, who joined the consortium in 2023, adding valuable perspective of an aircraft manufacturer. The composition of partners and the expertise each partner brings to the consortium is a prerequisite for creating impactful change in the aviation sector. The project is divided into two main focus areas: the supply, implementation, integration and smart use of Sustainable Aviation Fuel (SAF) and the development, integration and implementation of a Smart Energy system.

3.1 SAF focus area

The workstream centres around sustainable aviation fuels, and addresses challenges such as planning the future infrastructure of airports, procurement and ensuring the sustainability of SAF, as it can be produced from many feedstocks with various potential impacts on the environment and climate. These impacts are addressed to aid airports involved in the project, as well as other airports that will learn from the project's findings.

3.2 Smart energy focus area

The smart energy section of the project addresses the full chain of system mapping, energy management, and energy supply, including renewable energy and energy storage. As a part of the smart energy focus, there has been installed a Battery Energy Storage System (BESS) to gain valuable experience in, for example, the practical implementation of such a system at an airport, as well as how storage can aid in an increase in the use of renewable energy.

4 Background and concept of replication toolbox

The overall purpose of this report is to collect and distribute knowledge, experiences, methods, guidelines and tools developed through the Horizon funded project Alight (2020-2025), which will provide value for fellow airports working towards a more sustainable operation. The tools provided within this report are meant to support and facilitate knowledge transfer and the decision making at other airports within the areas of activities covered by Alight. The report will illustrate the complex outputs of the project to enable the replicability of the practical experience gained within the consortium and at Copenhagen Airports. Furthermore, the insights and feedback gained from the fellow airports of Aeroporti di Roma and Lithuanian airports, as well as the Centralny Port Komunikacyjny, will add to the understanding of the tools developed as well as how to best replicate and implement the various tools within an airport, which may vary in size, infrastructure etc.

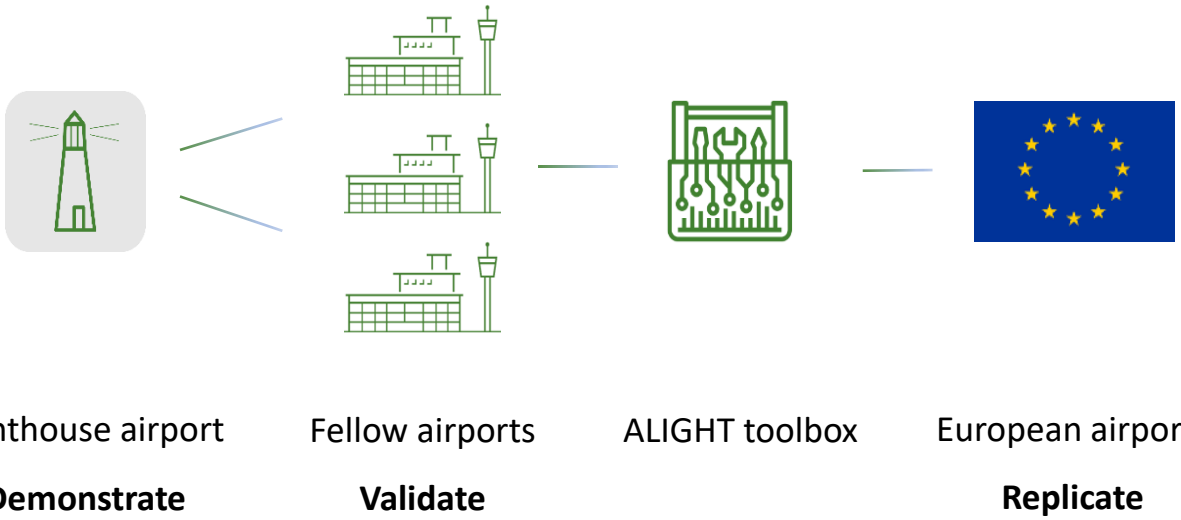

Figure 2: ALIGHT concept illustrated

Within the tools provided in this report it is crucial to consider the local context and local regulation as well as the local energy, environmental and climate commitments in addition to the context of the EU commitments. Thus, the tools and guidance are developed primarily in the context of Copenhagen Airport, why a Danish context may differ for an airport situated elsewhere in Europe or beyond.

Two toolboxes have been developed to reflect the two different focus areas of ALIGHT, the area of Sustainable Aviation Fuels (SAF) and the area of smart energy supply and use. The concept and the background of the toolboxes will be applicable for both toolboxes, as well as the consideration for sustainability holistically, however the content will vary depending on the focus area. Regarding sustainability it is defined as follows for the entire project:

Sustainability in ALIGHT encompasses the combination of social, economic and environmental aspects, with emphasis on environment to account for the aviation industry's climate impact. Thus, contributing to a long-term and inspiring decarbonization of the aviation sector.

For a more in-depth description of the concept and understanding of sustainability, as well as how it may differ from focus area to focus area, see deliverable 6.4 *the sustainability report.*

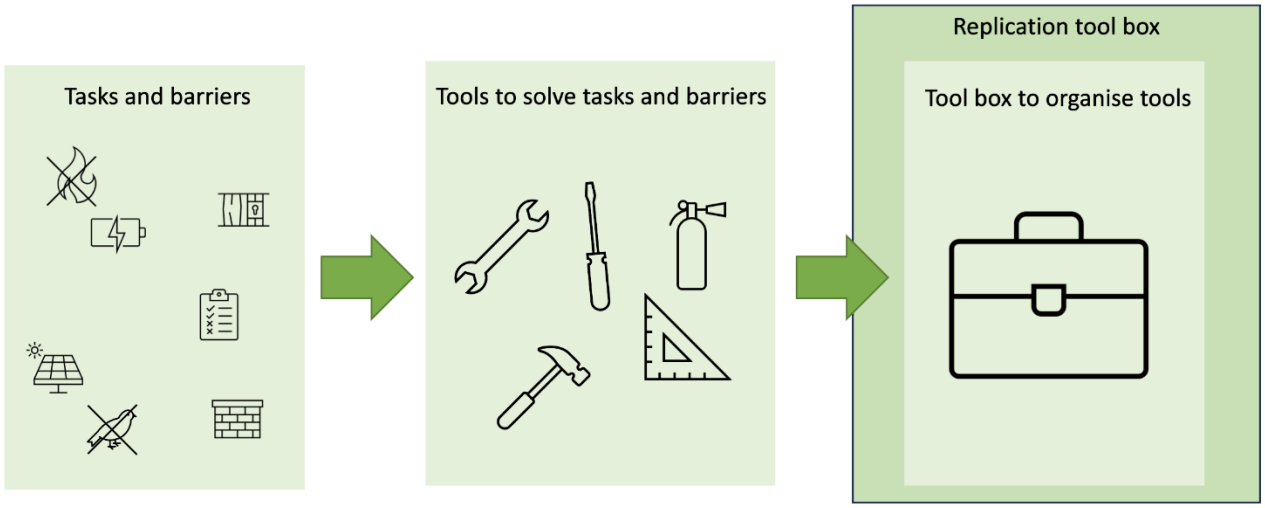

Figure 3 – Illustration of toolbox concept

4.1 Understanding of a replication toolbox

A common understanding of the toolbox is essential to ensure their effective use. Therefore, all partners in ALIGHT were asked the same question "*What is your understanding of a replication toolbox".* The intention of the exercise is to provide the reader with a shared understanding of both the purpose and content of the toolboxes. Thus, a toolbox is meant to support knowledge transfer and provide solutions to replicate, as well as practical recommendations and sharing of best practices. Survey answers can be found in Appendix 10.1.

5 Target group

This replication toolbox is primarily targeting airports and related stakeholders, which are considering, or already working with, a transition towards higher degree of sustainability.

Guidelines and tools included in the replication toolbox may be applicable to or useful for other industries either closely connected to airports or, especially for parts related to smart energy, by disregarding specific aspects regarding airports.

The guidelines and tools are based on experiences from the European funded project Alight and from European airports, why some cases may differ in other regions of the world. Some of the guidelines and tools are though in general terms, and may therefore be applicable for airports outside Europe.

The target readers of this report are sustainability managers, technical project managers, decision makers and other strategy developers in airports. Some of the tools are more technical and therefor targeting technical project managers and their teams of specialist or consultants working with topics inside the area of SAF and fuelling or smart energy in airports.

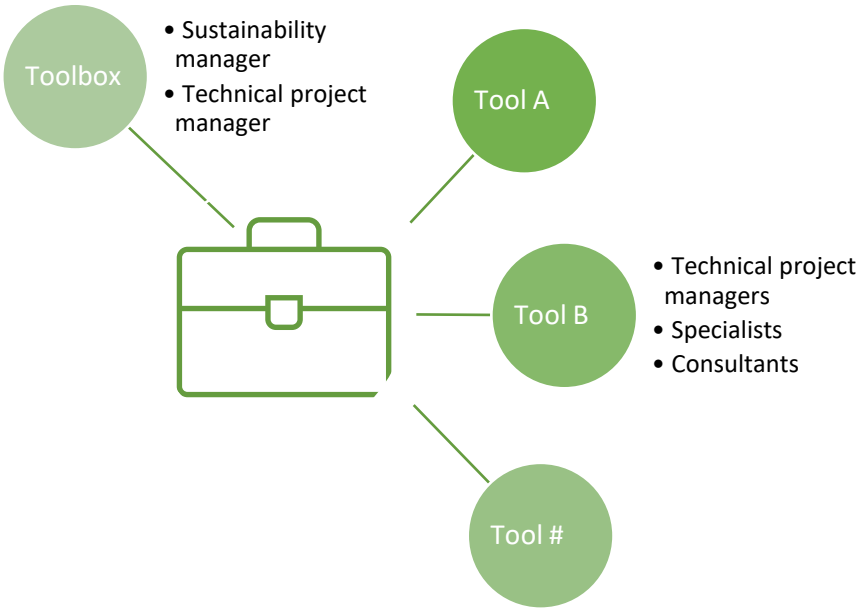

Figure 4: Illustration of tool target group example.

6 Boundaries and value chain for SAF toolbox

This replication toolbox for SAF includes information on the entire SAF value chain, while focusing on practical application within airport environments. The content of the toolbox is limited to the technologies and methodologies analysed and demonstrated in the ALIGHT project, where the SAF tools are related to the topics and technologies for SAF supply chain, Greenhouse effect, airport infrastructure and operations, and SAF management and compliance.

Most tools have a crosscutting impact and therefore appear in serval classifications.

Tool impact points

SAF Supply chain	Airport infrastructure and operations	SAF Management and compliance	Greenhouse effect
•Tool 2.1 •Tool 2.2 •Tool 2.4 •Tool 2.5 •Tool 2.6 •Tool 2.7 •Tool 2.8 •Tool 2.9 •Tool 2.13 •Tool 2.15	•Tool 2.2 •Tool 2.3 •Tool 2.4 •Tool 2.10 •Tool 2.13 •Tool 2.15	•Tool 2.2 •Tool 2.4 •Tool 2.7 •Tool 2.11 •Tool 2.12 •Tool 2.13 •Tool 2.14 •Tool 2.15	•Tool 2.1 •Tool 2.2 •Tool 2.3 •Tool 2.6 •Tool 2.13

Figure 5: Tool impact points overview

7 Value chain and stakeholders

The replication toolbox has been developed to support the project's value chain and stakeholders by helping airports outside the project implement successful initiatives within ALIGHT's main deliverables and deployed solutions. The toolbox outlines specific replication tools targeted to each stage of the relevant value chain, ensuring that airports and relevant stakeholders can efficiently adopt these practices. The tools developed for the SAF replication toolbox are primarily targeted specialists and decision-makers in airports but also support policy makers in decision-making on implementation of SAF initiatives. Within the 'SAF Management and Compliance' stage of the chain, all stakeholders in the value chain play an influencing role, though the end users, airlines, are the primary focus of the tools in this link of the chain.

7.1 SAF value chain

The tools presented support decision-making on the following areas of the value chain and impact points.

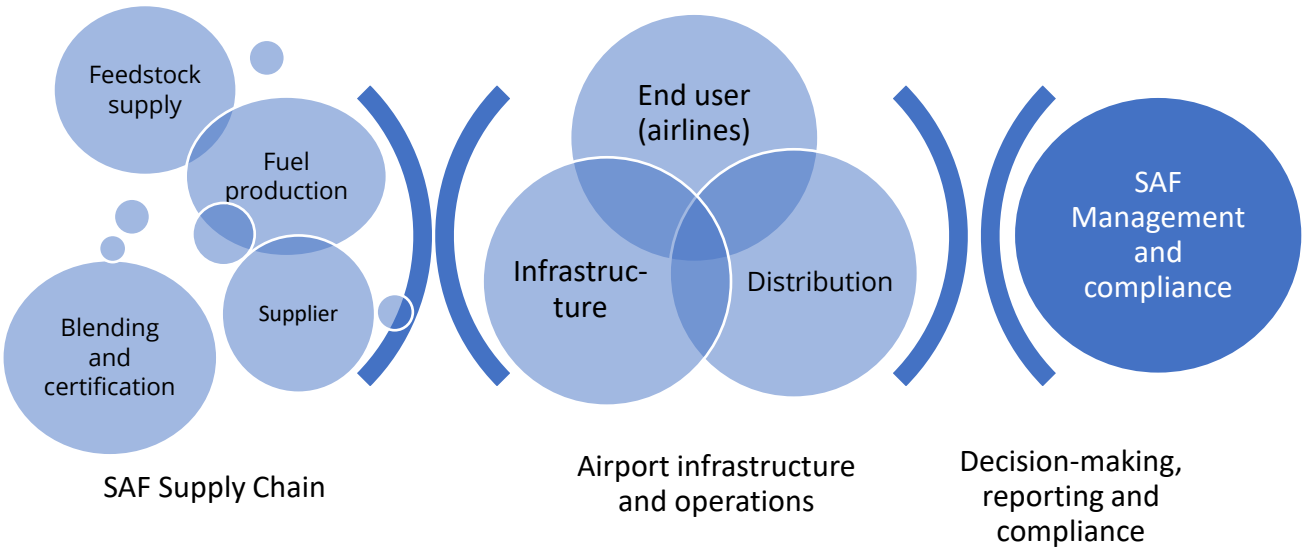

Figure 6: Covered SAF value chain areas by replication toolbox

8 Toolbox inventory

This section provides an overview of the tools developed in ALIGHT related to the field "Sustainable aviation fuel" as described in section 6 Value chain and stakeholders. All tools are attached to the report as separate documents named with identification numbers accordingly to the following descriptions. A "Tool description" is made together with each tool, which presents the purpose, target user, attention points and guideline on usage etc. These tool descriptions can be found in attachment with identification numbers matching the tools. An example is shown below:

- **Tool description:** 2.1 Tool description – "Name of Tool"
- **Tool:** 2.1 Tool – "Name of Tool"

Tool 2.1: Airport tool SAF

The purpose of this tool is to introduce airport sustainability teams to the fundamentals of SAF. Delivered as an interactive Excel file, the tool allows users to explore key topics such as SAF benefits, sustainability risks, GHG intensity factors, and policy drivers. It is designed to build foundational knowledge and support informed decision-making around SAF adoption. Users can navigate through various tabs to access structured information and basic GHG emissions calculations. Developed using RSB standards and 2022 data, the tool provides a practical entry point into SAF sustainability, though users should be aware that some content may require updates to reflect evolving standards and policies.

Tool 2.2 Sustainable airports platform communication tool

The purpose of this tool is to support airports in communicating the sustainability benefits of SAF to non-aviation audiences, such as passengers. Provided as a PDF, the toolkit presents key information on SAF production, environmental benefits, and sustainability in a clear and accessible format. It is designed to raise awareness and foster public understanding of SAF's role in reducing aviation emissions. Developed using RSB standards and based on 2022 data, the tool helps bridge the knowledge gap between technical SAF topics and general audiences. Users

should note that some content may require updates to reflect the latest SAF policies and standards.

Tool 2.3 APU emissions control

The purpose of the tool is to reduce GHG emissions from APU use at aircraft stands. The Auxiliary Power Unit (APU) supplies power to an aircraft's systems while it is on the ground, utilizing jet fuel, which results in greenhouse gas (GHG) emissions. When aircraft is "in block" and connected to ground power, the APU must be shut down.

The tool consists of an APU Monitoring system for data-driven communication with partners involved in aircraft turn around and resulting in possible business models for GHG emission savings from reduced APU use. With this advanced monitoring system, the airport will be able to: Identify active APUs and engage in discussions with pilots to encourage APU shutdowns. Gather data from aircraft stands to analyse APU usage patterns. Leverage this data to pinpoint initiatives aimed at reducing APU usage. Monitor and assess the effectiveness of these initiatives over time.

Tool 2.4 SAF readiness level - self assessment checklist

The purpose of this tool is to help airports, fuel suppliers, and aircraft operators assess their readiness to adopt SAF based on four predefined usage scenarios. The tool consists of tailored checklists for each stakeholder group, guiding users through a series of questions to determine the most suitable SAF implementation strategy for maximizing climate benefits. The tool supports strategic planning by identifying SAF readiness levels and recommending the next steps.

Tool 2.5 SAF Case study

These case studies serve as replication tools for airports aiming to integrate SAF into their fuel supply systems. They document the planning, implementation, and stakeholder engagement processes at ADR (proactive approach) and CPH (reactive approach), offering practical insights for other airports. The tools are relevant to airports, fuel suppliers, SAF producers, and service providers. Each case outlines a timeline and strategy that can be adapted to local infrastructure

and regulatory conditions. By showcasing real-world SAF integration, the case studies help stakeholders understand the operational, logistical, and policy considerations involved in SAF deployment, supporting informed decision-making and strategic alignment across the fuel handling value chain.

Tool 2.6 Best practice handbook and tools for fuel logistics, quality monitoring, and accounting

The handbook is a practical tool to be used as guidance to determine the readiness level of fuel suppliers, airports, aircraft operators, and all stakeholders along the value chain for SAF adoption. It is designed to enhance readers' technical capacity and core skills on SAF, address concerns with clear and accurate guidance on safety, supporting regulations, the use of logistics infrastructure, and quality and sustainability certification. Ultimately, this handbook is designed to accelerate SAF adoption through a practical self-evaluation readers can use to define their role within the value chain and take action, become a valued player in the supply and use of SAF and help lead the transition to sustainable aviation.

Tool 2.7 Checklist of the origin, composition and sustainability of SAF products

The SAF Purchasing Checklist is designed to help stakeholders make informed decisions when procuring SAF. It supports users in evaluating SAF products based on origin, composition, sustainability, and compliance with regulations such as EU RED II/III and CORSIA. The tool empowers users to ask the right questions about feedstocks, supply chains, certification, and procurement models. It also highlights the importance of transparency, traceability, and regulatory alignment. The checklist is a practical guide to ensure due diligence, promote best practices, and support sustainability goals in SAF procurement.

Tool 2.8 The SAF Pool Program

The SAF Pool Program aims to bring together airlines and other SAF buyers to jointly place bulk orders for SAF, thereby achieving better pricing and improving market access. It addresses the challenge of fragmented procurement by creating a collaborative model that enhances purchasing power and simplifies logistics. The tool also fosters industry-wide cooperation on

climate action and provides practical experience with SAF procurement. However, it requires strong coordination, legal clarity, and stakeholder commitment to succeed.

Tool 2.9 Global overview of SAF producers

The SAF Map provides an up-to-date overview of manufacturers, SAF pathways, methods, quantities, and supply timeframes. The purpose is to create awareness of developments in the SAF market. The overview is provided both as a map and a list.

Tool 2.10 Checklist for Airport's role in SAF purchase and development

This checklist helps airports assess and define their potential roles in supporting SAF adoption. While airports are not directly involved in fuel procurement, they can act as facilitators or active participants in SAF initiatives. The tool outlines possible actions airports can take—such as co-financing, infrastructure investment, or stakeholder engagement—to promote SAF use. It also highlights the structural and regulatory boundaries airports must navigate, helping them identify feasible contributions to climate goals.

Tool 2.11 Checklist (or option): for Airports' access to SAF data for scope 3 reporting

This tool supports airports in accessing and managing data on SAF deliveries to enable accurate Scope 3 emissions reporting. It addresses the challenge of collecting third-party emissions data from airlines, fuel suppliers, and authorities. The checklist helps airports establish agreements and systems for data sharing, ensuring transparency and alignment with sustainability goals. It also highlights the importance of standardized data formats and legal clarity.

Tool 2.12 SAF purchasing option - Fly Green Fund

The Fly Green Fund (FGF) model enables individuals and companies to reduce their climate impact by funding SAF purchases. It offers a transparent, certified alternative to traditional carbon offsetting. The model supports SAF market growth by pooling voluntary contributions and purchasing SAF from certified producers. It also promotes awareness and supports research into SAF development.

Tool 2.13 Guideline for segregated SAF delivery and storage options (Non-CO2)

This tool highlights the potential of segregated SAF delivery to reduce non-CO_2 emissions, such as contrail formation and particulate matter. It provides guidance on infrastructure, logistics, and strategic deployment of high-blend SAF on specific routes. The tool supports decision-making on when and where segregated delivery is most effective.

Tool 2.14 Implementation plan for common eSAF recommendations based on national initiatives

This tool presents a transferable model based on Danish national initiatives aimed at promoting fossil-free aviation. It provides structured guidance for companies, startups, and stakeholders to replicate successful strategies, including political anchoring, financing models, EU approval processes, and MRV systems. The purpose is to inspire and support similar efforts in other regions by sharing practical steps, lessons learned, and implementation frameworks. It helps stakeholders align with climate goals and regulatory requirements while fostering innovation and collaboration.

Tool 2.15 Online Dashboard for the digital platform for SAF

Data-driven analysis and modelling play a key role in exploring solutions within a complex, multi-stakeholder system like the SAF value chain. The digital platform for SAF provides a broad data foundation for aviation fuels, along with flexible models to predict and analyze fuel properties and their impact on emissions. As the digital platform is primarily a software tool for expert users, the online dashboard offers a simplified view of selected outcomes, making key insights accessible to non-domain experts.

9 Online facilitation of replication toolbox

A part of the replication toolbox is an online platform that clearly communicates the various tools, extracted from the deliverables of ALIGHT to a variety of stakeholders and users in the aviation industry and beyond. The online replication toolbox will communicate all findings to a diverse audience primarily within or adjacent to the aviation industry, as well as decision makers and policy makers.

The online replication toolbox is primarily aiming at inspiring and facilitating the replication and scale-up of the solutions and results developed, found, and tested throughout ALIGHT. To effectively achieve this, the online toolbox provides practical guidance on how to use the learnings and findings of ALIGHT to implement in other airports, or other, similar contexts even when these may differ from those of the lighthouse and fellow airports. This online toolbox ensures that valuable results of ALIGHT have a broad and significant impact that extends well beyond the airports directly involved in the ALIGHT consortium.

The online toolbox provides easy access to the wealth of knowledge gathered throughout the duration of ALIGHT, to stakeholders all over the EU and beyond, including airports not directly involved in the project, airlines companies, fuel suppliers and handlers, technology providers, local, regional, and national authorities, city planners, policymakers, standardisation bodies as well as the wider aviation sector and smart city stakeholders.

The architecture of the online replication toolbox is based on a landing page where the user can easily understand and navigate between relevant topics rather than workstreams and work packages making the tools accessible to users outside the ALIGHT project. A mockup of the landing page is presented in Figure 7.

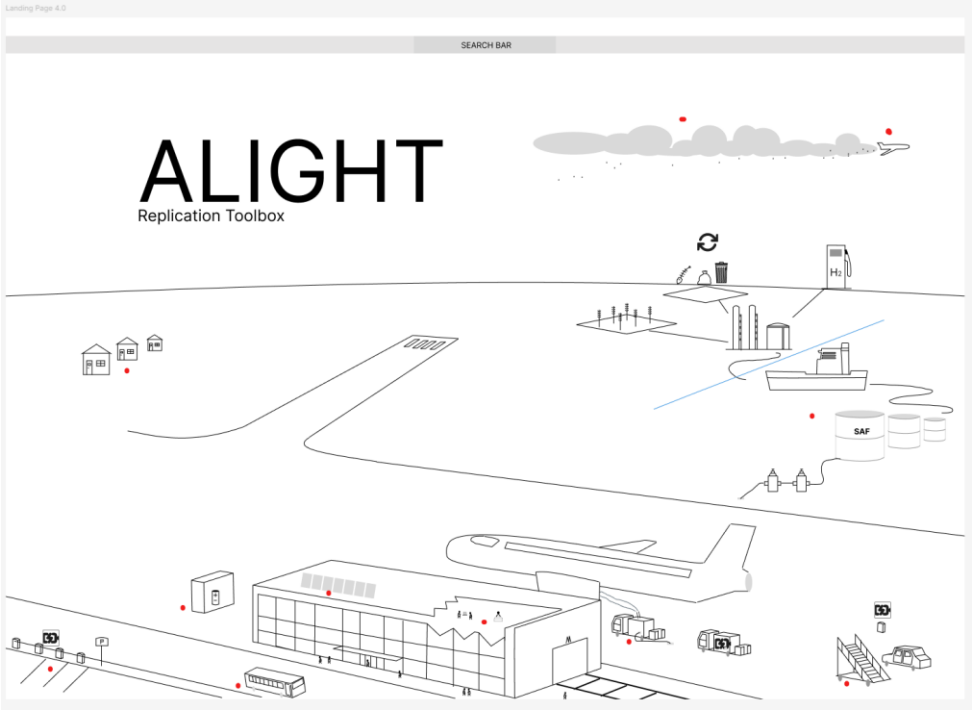

Figure 7 – A mockup of the landing page design of the replication toolbox.

The landing page is the entry point from where the user can dive into specific topics. When entering a topic, all relevant tools within this topic will be presented. This concept is illustrated in Figure 8.

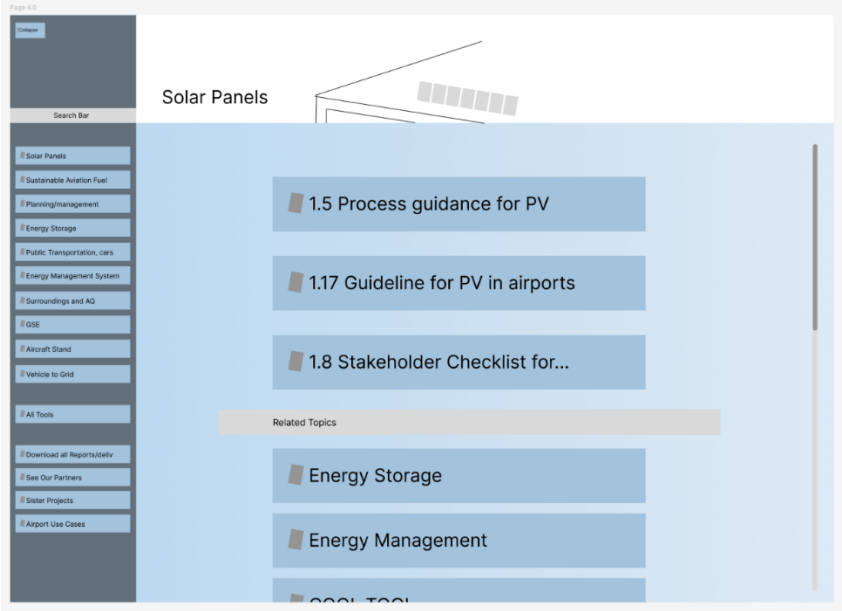

Figure 8 – This mockup of the webpage shows the topics and tools of the toolbox *and different actions.*

Moreover, each tool will be presented and available directly or for download in the online replication toolbox.

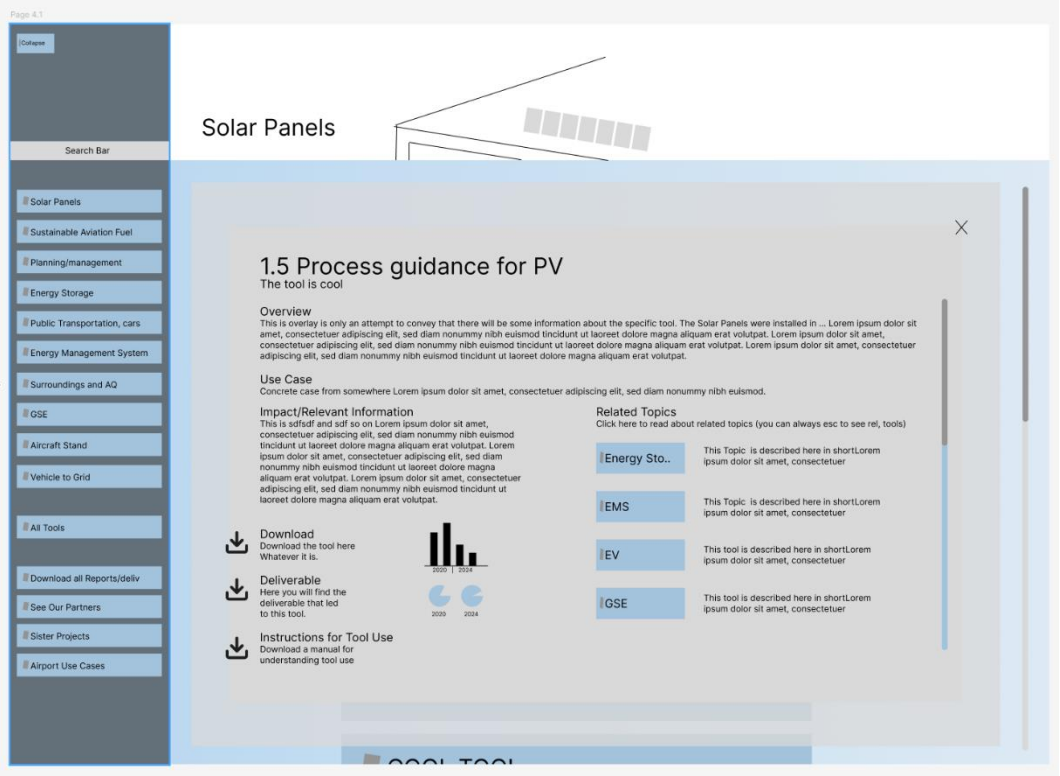

Figure 9 – This mockup of the webpage shows an overlay that provides information about the tools as well as downloads and other actions. There are no dead ends in the toolbox, and users are continuously invited to consider other relevant tools.

10 Annex

10.1 Survey answers